

What is claimed is:

1. A method for manufacturing a reticle blank usable for fabricating a segmented reticle for use in charged-particle-beam microlithography, the method comprising:

5 preparing a reticle substrate comprising a silicon substrate, the reticle substrate having first and second major surfaces;

beginning on the second major surface, discharge-machining part way into a thickness dimension of the silicon substrate toward the first major surface so as to form from the silicon substrate a grillage of intersecting struts separating respective 10 subfield regions from one another; and

in regions not occupied by respective struts, dry-etching further into the thickness dimension of the silicon substrate toward the first major surface until each subfield region includes a respective membrane formed by a residual portion of the reticle substrate extending into the thickness dimension from the first major surface.

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2. The method of claim 1, wherein the discharge-machining step is performed using a discharge-machining electrode placed, at initiation of discharge-machining, adjacent the second major surface and separated therefrom by a discharge gap.

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3. The method of claim 2, wherein:

the discharge-machining electrode comprises a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

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between the grooves are projections that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the subfield regions.

5 4. The method of claim 3, wherein:

the reticle blank is formed to have a pattern-defining zone having an area; and

the discharge-machining electrode has an area that is smaller, by an integer ratio, than the pattern-defining zone.

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5. The method of claim 3, wherein each groove has a width equal to two times the discharge gap, plus a desired width of the corresponding strut to be formed by the groove.

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6. The method of claim 1, wherein the step of preparing a reticle substrate comprises preparing a silicon-on-insulator (SOI) wafer substrate, comprising a silicon oxide layer and a silicon layer on the first major surface.

20 7. The method of claim 6, wherein the silicon oxide layer is formulated to be an etch-stop layer.

8. The method of claim 6, wherein dry-etching is continued through the thickness dimension to the etch-stop layer.

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9. The method of claim 6, wherein the step of preparing a reticle substrate comprises forming a metal layer on the second major surface.

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10. The method of claim 9, wherein the discharge-machining step is performed using a discharge-machining electrode placed adjacent the metal layer and separated therefrom by a discharge gap.

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11. The method of claim 10, wherein:

the discharge-machining electrode having a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

10 struts: and

between the grooves are projections that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the subfield regions.

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12. The method of claim 9, wherein dry-etching is performed using remaining portions of the metal layer as an etching mask.

13. A reticle blank manufactured by a method as recited in claim 1.

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14. A method for fabricating a segmented reticle for use in charged-particle-beam microlithography, comprising:

fabricating a reticle blank using a method as recited in claim 1;

forming a layer of resist on the first major surface of the reticle blank, the layer of resist being patterned according to a desired reticle pattern; and

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using the patterned resist as a mask, forming elements of the pattern on the reticle blank.

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15. A reticle fabricated by a method as recited in claim 14

16. A method for manufacturing a reticle blank usable for fabricating a
5 segmented reticle for use in charged-particle-beam microlithography, the method
comprising:

10 preparing a reticle substrate from an SOI wafer comprising a relatively thick silicon substrate layer having first and second major surfaces, the silicon substrate having a thickness dimension and including a relatively thin silicon oxide layer on the first major surface and a relatively thin silicon layer superposed on the silicon oxide layer, and a relatively thin metal layer on the second major surface;

beginning at the metal layer on the second major surface, discharge-machining into the silicon substrate toward the first major surface through most of the thickness dimension so as to form from the silicon substrate a grillage of intersecting struts separating respective subfield regions from one another;

in regions not occupied by respective struts, dry-etching further through the thickness dimension of the silicon substrate to the silicon oxide layer, serving as an etch-stop layer, so as to provide each subfield region with a respective membrane formed by the silicon oxide layer and relatively thin silicon layer; and

removing exposed portions of the silicon oxide layer

17. The method of claim 16, wherein the discharge-machining step is performed using a discharge-machining electrode placed, at initiation of discharge-machining, adjacent the metal layer and separated therefrom by a discharge gap.

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18. The method of claim 17 wherein:

the discharge-machining electrode comprises a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

5 between the grooves are projections that correspond in respective
dimensions, positions, and arrangement to desired respective dimensions, positions,
and arrangement of the subfield regions.

10 19. The method of claim 17, wherein dry-etching is performed using
remaining portions of the metal layer as an etching mask.

15 20. A reticle blank manufactured by a method as recited in claim 16.

20 21. A method for fabricating a segmented reticle for use in charged-
particle-beam microlithography, comprising:
 fabricating a reticle blank using a method as recited in claim 16;
 forming a layer of resist on the first major surface of the reticle blank, the
layer of resist being patterned according to a desired reticle pattern; and
 using the patterned resist as a mask, forming elements of the pattern on the
reticle blank.

25 22. A reticle fabricated by a method as recited in claim 21.